BIODIVERSITY: Conserving Endangered Species

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Biodiversity is the abundance and variety of species in the world or in an area. This simple concept has given rise to laws to preserve biodiversity as scientists began to learn that ever-increasing numbers of plants and animals have been disappearing since humans began dominating the Earth with machines. The Endangered Species Act has some success in protecting species, but it has also been mired in debate and controversy, especially when saving an endangered species conflicts with economic needs. Individuals can to preserve biodiversity by the task requires cooperation between governments and scientists and a good deal of honest communication so that opponents of species protections understand that human life will follow right behind all other life if a mass extinction occurs. Biodiversity studies combine a variety of biological sciences with social sciences, ethics, and philosophy. Perhaps biodiversity will be saved only by understanding the big picture of life's place in the universe. Scientists can then use that understanding as a driving force for their detailed studies on individuals, species, and habitat.

The status of species in the wild most often results from the condition of their habitat. Healthy habitat indicates that food webs function efficiently and all members of the web have sufficient resources for food, shelter, and raising young. Damaged habitat, by contrast, contributes to biodiversity loss. The main causes of habitat damage are size reduction, fragmentation, destruction, and pollution; all of these problems result from human activities. Biologists use a wide variety of techniques to assess habitats and species populations. These methods range from on-the-ground studies in which teams count individual plants or animals to sophisticated electronics that track animals and take images of habitats. Sound monitoring techniques enable environmental scientists to focus on specific problems related to biodiversity. Some biodiversity threats are obvious, such as the takeover of an ecosystem by an invasive species. Others are obvious but complicated, such as the myriad effects of human activities on ecosystems. All of these methods and the data they produce have one advantage in common: They produce data that scientists can use to alert the world of a coming crisis in biodiversity loss.

Invasive species may be more threatening to biodiversity than habitat loss: habitats can be rebuilt in almost original condition, but some species seem to have found their niche as invaders that cannot be defeated by humans. In this sense, invasive species may grow to be the ultimate weapon that destroys biodiversity unless people take aggressive steps to reclaim habitat for the native species that remain.

New technologies in environmental science will at the least give scientists a better chance to identify biodiversity's biggest threats and develop more methods to conserve species. The test will be to develop species-saving technologies before urbanization eats up every last trace of the natural world.

Conservation biologists depend on reserves, sanctuaries, and Biodiversity artificial habitats to maintain populations of endangered animal species. The most endangered species may require technologies provided only by zoos, aquariums, and a small number of veterinary colleges. For this purpose zoos and aquariums have transformed themselves from places that once contributed to animal endangerment to important protectors of biodiversity.

Protections come in the form of government-run reserves, private sanctuaries, and zoos and aquariums. Even the largest reserves have boundaries, so they cannot be thought of as truly wild. But restricted places like nature reserves may become the only places where critically endangered animals can have a future. Some countries have turned to ecotourism rather than industry for their national income and therefore protect their biodiversity hotspots. But humans remain a threat to protected places, even nature reserves. Poaching and the international wildlife trade remove many animals from protected habitats each year.

Species protection includes a combination of wide-reaching international laws and local efforts. Either internationally or locally, protection efforts now incorporate many disciplines in order to succeed. Preserving endangered species has become a matter of economics, social and cultural values, politics, and even religion in addition to biology. This is because there are few places on the Earth not affected in some way by human activities and human behavior. Biodiversity suffers today from extremes in poverty and affluence. These conditions directly or indirectly cause species loss. International organizations have helped get various nations to cooperate on halting the worst activities that cause biodiversity loss, but much more cooperation will be needed to divert species from extinction. Large, well-funded organizations can use sophisticated methods for monitoring the status of the world's species, and ordinary citizens can join local efforts to protect wildlife, but wildlife protections remain hampered by a combination of cultural values, myth, misinformation, and real economic needs. The technologies for saving

biodiversity have improved over the past several decades, but technology may not be the most difficult part of bio-diversity programs. The difficult aspect of saving biodiversity and protecting species comes from the need to create open communications among local and national governments, environmentalists, scientists, large and small businesses, and even religions. In other words, human cultural values impact species protections as profoundly as they affect wealth, poverty, war, and peace.

All studies of biodiversity depend on data so that scientists can assess bio-diversity hotspots and biodiversity loss. These data accumulate after years of scientific studies on individual species. In measuring biodiversity of plants, animals, insects, aquatic species, or any other living thing, rich-ness and rarity are key pieces of information. Richness is the number of individuals of each species in a given region. Ecologists evaluate richness to assess biodiversity. Rarity, the infrequency of a species, occurs if an animal normally exists in low numbers or is nearing extinction. Most measurement techniques are labor-intensive methods called field studies that depend on scientists' going into natural settings to catch, Methods for Measuring Diversity trap, or listen to animals. Field studies give biologists estimates of animal numbers, but after many years of accumulating data on species, their esti-mates can be very accurate for terrestrial animals. The methods for aquatic species are similar, but so far scientists have accumulated less information about these species.

All of the measurements described in this chapter help environmental scientists rank species according to their likelihood of premature extinction. Different organizations use slightly different terminology in their ranking systems, but overall, they agree with five major groups: critically endangered, endangered, threatened, near threatened, and secure. Biodiversity protections will depend on further advances in the technologies scientists use for assessing species. With each advance, environmental science can develop more useful and meaningful protections for individual species, their habitats, and as a result, global biodiversity.